Automation India

Enabling Global Competitiveness

Issue 6 – April 2006 A newsletter of the Automation Industry Association of India

Dear Friends,

The first issue of Automation India was introduced to you in June 2004 by our founding Honorary President, Mr. Ravi Uppal. Having overseen the successful launch of Automation Industry Association (AIA), Mr. Uppal handed over charge to the new team of myself and Hon. Vice President Mr Ranjan De at the Executive Council meeting on Feb 25, 2006. On behalf of members of the Executive Council, I want to place on record our sincere thanks to Mr Ravi uppal for championing the cause of AIA in its formative period. As the incoming President, its my great pleasure to present to you this issue of Automation India.

In continuation of AIA's focus on key Industry Verticals in which Automation can play a significant role in creating global competitiveness, our next Industry Vertical Event – Food Tech 2006 is to be held at Hotel Hyatt Regency, New Delhi, on April 7, 2006. Hon. Minister of State for Food Processing (independent charge) Mr Subodh Kant Sahai will be the Chief Guest at the inaugural session of Food Tech 2006 and will deliver the inaugural address. Given Government of India's sharp focus on the Food Processing Sector in budget 2006-07, the Minister's presence and his address promises to be an important milestone in India's mission to build an Industry of global scale.

This edition of the AIA newsletter is dedicated to innovative use of Automation in Food Processing. I urge members of the Food processing community and of the OEM and Automation sector to create common interest groups and continue the dialogue beyond Food Tech 2006.

With best wishes,

JP SINGH
Hon. President, AIA

MINISTER OF STATE
FOR FOOD PROCESSING INDUSTRIES
(Independent Charge), Government of India
Panchsheel Bhawan, August Kranti Marg
New Delhi

31st March 2006

Message

I am happy to learn that the Automation Industry Association of India (AIA) is organizing a Seminar on Automation in Food & Beverage Industry.

Ministry of Food Processing Industries is engaged with the challenge of creating a unique partnership between the Indian farmer and the Indian industrialist. And, the Indian technologist is the catalyst for this partnership.

Use of Automation Technology in Food Processing is a vital ingredient in the country's overall model of achieving economies of scale. The Food Processing Industry is one where scale counts and to that end, automation can serve a salutary purpose. Our Government's policies encourage all forms of entrepreneurship, from the small sector to the large industrial houses and co-operatives. The opportunity and challenge of food processing industry and the automation industry is synergistic. I am glad that AIA is bringing out a special edition of its newsletter dedicated to applications in food processing.

I am sending my best wishes for the success of the Seminar.

(SUBODH KANT SAHAI)

Combustion System Solutions for the Food Industry

Automation for combustion processes in the food industry, is enabling comprehensive solutions across the food processing spectrum. From oven controls to heat recovery steam generator systems, automation technology, engineering and process solutions are helping leading food manufacturers optimize manufacturing to achieve ever-increasing standards for quality, productivity, and cost.

Challenges

With the intense, relentless competitive pressure, and changing regulatory requirements affecting the food industry, more than ever, the difference between success and failure is determined by which producer is most successful in the area of process optimization. When surveying manufacturers in the food industry, the single greatest obstacle to achieving higher levels of optimization is unscheduled plant downtime. Often the most costly sources of unexpected downtime involve the combustion systems used throughout the manufacturing process. These unexpected shut downs are often caused by nuisance trips, old, unreliable or unsupported control systems, and defects in the control system design.

If your operation has been impacted by these unexpected shutdowns, or if you are looking to increase efficiency, safety, or monitoring of your combustion system, an automation expert can help.

Solution

A complete solution for combustion processes in the food industry includes comprehensive specification, project coordination, start-up and support for: burner management systems, combustion and temperature control systems used for boilers, ovens, roasters, dryers, incinerators, oil heaters, toasters, as well as heat recovery steam generators, and general balance of plant controls.

With the food manufacturer in mind, solutions are designed, and engineered with high availability, and embed features that help operate and maintain the systems without unexpected interruptions due to process malfunctions. Features such as detailed diagnostics, operator help messages, and first-out alarms are only a few of the unique offerings users can expect to ensure ease of maintenance and support.

A complete solution also provides the connectivity needed to integrate the combustion system to production and information systems, enabling you to gather and analyze data to optimize your energy efficiency, implement effective preventative maintenance processes, and optimize your overall process. Integrated architecture promotes fast start-up, reduced maintenance costs and the ability to share data and diagnostic information across the plant floor as well as with clients' information and execution systems.

- Reduce Energy Costs Through Enhanced Combustion Efficiency
- Improve Quality With Tighter Temperature And Steam Control
- Integrate The Combustion Process With Factory Automation And Information Systems
- Simplify Operation And Maintenance With Intuitive Graphical Displays and Detailed Diagnostic Capabilities, Including Alarm Status and History
- Reduce Start-Up And Downtime Costs With Proven, Programmed And Tested Pre-Wired systems, Ready For Installation.

— Samit Paul

Information Solutions: Improve Profitability with Investment in MES

An analysis of *Industry Week* Best Plant winners and finalist data over a four-year period (1998–2002) shows that manufacturing execution system (MES) implementation provides considerable performance advantages. Plants using MES have improved profitability by four times as much as those not using MES. The analysis shows that plants using MES outperform those that don't – and improve plant performance faster – in all of three performance areas:

- Productivity. Plants using MES have higher productivity and have improved operational productivity more rapidly over the previous three years. Plants with MES were able to reduce costs – including those related to manufacturing, product, and energy – more dramatically than plants not using MES.
- Process Improvement. Plants with MES have higher process capability and larger yield gains. Furthermore, plants using MES have a greater reduction in cycle times and are more advanced in developing a true build-to-order model to meet just-in-time demands.
- Personnel Performance. New employees require less training in plants that use MES. Plants using ERP, Six Sigma, Lean Quality and demand flow scheduling techniques all show benefits from using MES.

MES *vs.* ERP

The Manufacturing Enterprise Systems Association, MESA International, defines MES as "a dynamic information system that drives effective execution of manufacturing operations. Using current and accurate data, MES guides, triggers and reports on plant activities as events occur. The MES set of functions manages production operations from point of order release into manufacturing to point of product delivery into finished goods. MES provides mission-critical information about production activities to others across the organization and supply chain via bi-directional communication."

While an enterprise resource planning (ERP) system is sold as a comprehensive manufacturing system, very few plants have found it to be effective in assisting plant personnel. Among Best Plants using ERP, the 59 percent with MES as well have improved profitability 4.3 times as much over 3 years – 413.3 percent vs. 96.2 percent. ERP helps plan and oversee manufacturing, but improving production execution requires detailed functionality that only MES provides.

Plants using MES have higher productivity than those not using MES by all three measures included in the Industry Week Best Plants survey: sales per square foot, sales per employee and value-add per employee.

Naturally, productivity growth is a key driver of growth in profitability. Here again, plants using MES showed a clear advantage over those not using MES. Productivity growth over the prior three years ranges from 70 percent higher to over six times higher for plants using MES. Those using ERP found MES an even greater boost to productivity.

One of the keys to improvement, as many companies implementing Six Sigma and other programs have discovered, is having accurate, detailed data to identify the root cause of problems. MES helps provide that type of production data.

Measure	Plant using MES
Profit Improvement	400% + higher gains — 3 years
Productivity	84% higher revenue/square foot 32% higher value-add/employee 10% higher sales/employee
Productivity Improvement	630% greater improvement in revenue/sq.ft. 70% greater improvement in value-add/employee 200% greater improvement in sales/employee
Cost Reduction Over 3 years	34% greater cost reduction
Energy Consumption Reduction	57% greater energy reduction
Process Capability	11% better Cpk — 2 vs. 1.8
Yield Improvements	15% greater improvement
Cycle Time Reductions	37% greater mfg. cycle time cuts; 22%+ order-to-ship
Employee Effectiveness	78% as much training needed

Further, MES helps reduce errors that waste materials as well as employee and production equipment time. Over 58 percent of those with Six Sigma initiatives use MES as well.

MES cuts costs

Nearly every manufacturing company has faced price pressures over the past few years. To maintain healthy profits, costs must be cut. Again, those using MES have managed to outperform those not using MES. While their customer prices dropped more, their cost reductions were also greater. This data suggests that companies in industries that need to

Keeping Track for Competitive Advantage

make regular improvements in costs and productivity to compete effectively — such as food and beverage — should consider MES.

Another aspect of productivity where MES appears to provide a significant boost is in a plant's ability to reduce energy consumption per unit of production. All of the best plants managed to cut energy consumption, but there is a 57 percent difference. Plants not using MES achieved a 12.3 percent reduction compared to a 19.3 percent reduction for those using MES. In process and mixed mode industries, where energy consumption is often a larger cost, the reduction is even greater.

This reduction can most likely be attributed to MES core capabilities such as a unified plant-wide view of production that leads to greater overall efficiencies, operator support to reduce errors and waste, and detailed data to track down root causes when a problem arises.

In an era where return on assets (ROA) and operating costs are critical metrics of company financial health, top executives will be looking for ways to enhance productivity. This study of best plants shows that MES enhances the rate of performance improvements that production facilities can achieve.

— Mukund

New requirements to track and trace all materials used in food and animal feed manufacturing can be costly and time consuming for food and beverage manufacturers. When faced with such demands, the first questions many food industry executives ask is why tracking and tracing must be done. There are several reasons:

- Supply chain responsiveness to meet the demands of the retailers for on-time delivery and accurate information on deliveries.
- Improved inventory management: reduction of inventory, waste and overproduction associated with safety stock.
- Improved quality and consistency.
- Protecting brand equity.

All of these reasons mean that an intelligently implemented tracking and tracing system can translate to a competitive advantage for a manufacturer.

Implementing systems

Food and beverage manufacturers can implement tracking and tracing in one of two basic ways. The first is to spend the minimum amount necessary to comply with government regulations. This path will provide little or no improvement to quality and consistency and no reduction in costs. This path can also result in substantial additional expense when government regulations become more stringent or when supplier requirements change.

The second path is to install a tracking and tracing system that does more than just meet government requirements. Food and beverage manufacturers can install tracking and tracing systems that meet existing and anticipated demands from suppliers and government agencies, reduce inventory, reduce final product costs and improve quality and consistency.

Regulations affecting the food and beverage industry continue to evolve in the direction of regulations in the pharmaceutical industry, which require pharmaceutical companies to generate a complete batch record and meet the requirements of 21 CFR Part 11. Implementation of a well-designed tracking and tracing application positions food and beverage companies to meet potential regulations.

Food and beverage manufacturers are now investigating tracking and tracing applications and how they need to respond to the governmental regulations for traceability. Smart companies are looking at ways to leverage these applications to improve operations and achieve a quantifiable return on the investment.

WHY TRACK AND TRACE?

1. To comply with regulations and mandates
2. To increase supply chain responsiveness
3. To improve inventory management
4. To improve quality and consistency
5. To protect brand equity

Advantages

Manufacturers striving to improve the responsiveness of their supply chains can meet the demands of the retailers for on-time delivery and accurate information on deliveries (RFID on pallets). Failure to respond to these demands will result in lost contracts with retailers and wholesalers.

Tracking material usage at the manufacturing plant enables food and beverage companies to manage inventory more accurately at the plant level. At many plants, inventory usage is determined based on standards. Actual inventory is reconciled to the business system every week or month by taking a physical inventory. To ensure that there is adequate inventory on hand, food manufacturing companies need to carry additional inventory as a safety stock.

A tracking and tracing solution enables the company to track actual usage, so the safety stock can be reduced, freeing capital and reducing operating expense.

When it comes to quality and consistency, the challenge for the manufacturing company is to have enough correlated data to allow it to analyze operations and make improvements. The tracking and tracing applications collect all the key data for each process step, including raw material used, operating conditions, personnel and quality of the product. Batches or products that had excellent yield and quality can be reviewed to understand optimal conditions.

Similarly when a bad batch or product is produced, the operation can be reviewed and compared to excellent batches to understand the key reason for the difference. Based on these analyses, companies can alter their standard operating procedures to optimize production.

Better cost analysis

Manufacturing companies seek to understand the cost of manufacturing each product. Because of the lack of data, they use standard costs developed using data over an extended period of operating history. The companies are challenged to be the low-cost producer and must compare the cost of manufacturing at each of their manufacturing facilities and the cost of a co-manufacturer.

Tracking and tracing applications can provide much of the raw data to give a more complete view of the actual cost of manufacturing the product. The application collects data on actual usage, waste/scrap, the amount of labor deployed and operating conditions. Based on this data, companies can more clearly understand their costs and make better decisions to reduce manufacturing costs.

— Debashish Ghosh

HAZARD ANALYSIS & CRITICAL CONTROL POINT (HACCP)

Traditionally, industry and regulators have depended on spot-checks of manufacturing conditions and random sampling of final products to ensure safe food. This approach, however, tends to be reactive, rather than preventive, and can be less efficient than the new system.

The new system is known as Hazard Analysis and Critical Control Point, or HACCP (pronounced hassip).

Space-age technology designed to keep food safe in outer space may soon become standard here on Earth!

HACCP involves seven principles:

Analyze hazards. Potential hazards associated with a food and measures to control those hazards are identified. The hazard could be biological, such as a microbe; chemical, such as a toxin; or physical, such as ground glass or metal fragments.

Identify critical control points. These are points in a food's production—from its raw state through processing and shipping to consumption by the consumer—at which the potential hazard can be controlled or eliminated. Examples are cooking, cooling, packaging, and metal detection.

Establish preventive measures with critical limits for each control point. For a cooked food, for example, this might include setting the minimum cooking temperature and time required to ensure the elimination of any harmful microbes.

Establish procedures to monitor the critical control points. Such procedures might include determining how and by whom cooking time and temperature should be monitored.

Establish corrective actions to be taken when monitoring shows that a critical limit has not been met — for example, reprocessing or disposing of food if the minimum cooking temperature is not met.

Establish procedures to verify that the system is working properly — for example, testing time-and-temperature recording devices to verify that a cooking unit is working properly.

Establish effective recordkeeping to document the HACCP system. This would include records of hazards and their control methods, the monitoring of safety requirements and action taken to correct potential problems. Each of these principles must be backed by sound scientific knowledge: for example, published microbiological studies on time and temperature factors for controlling foodborne pathogens.

Matching the Benefits of Automation

Definitions

Automation: The electronic control of brewing, fermenting, and packaging equipment, including mechanical interlocks and permissives, to execute the brewing process independent of or facilitated by the Brewer.

Information Infrastructure: Utilization of appropriate software applications to accomplish business tasks including financial, operation, maintenance, and supply chain demands.

Corporate Lifecycles Definitions

Courtship: Brewing business concept is born. Is the process of building and defining, the vision, commitment, and energy to sustain the origination of a business. Founder must be committed to the beer, not the profit.

Infancy: The business becomes real. Transition from thinking about doing some to action. Cash flow is critical. Action oriented. Founder makes all decisions. Commitment built in Courtship is continuously tested.

Go-Go: Business begins to flourish, focus shifts from cash flow to sales. Business is organized around people, not tasks. The organization is not controlling the environment, but is being controlled by it.

Adolescence: Organization develops a personality apart from the Founder. Processes and systems are crucial for further growth. This is the point when entrepreneurial turns into professional management.

Prime: The organization reaches the optimum point on the lifecycle curve achieves a balance between self control and flexibility. The challenge is to stay at this point.

Stable: The first of the aging stages. The organization is strong, but beginning to loose its flexibility. It is the end of growth and the beginning of decline.

Affair: Not enough commitment is developed to move forward with the organizational idea. Business dies before it begins. Courtship without reality testing.

Infant Mortality: The infant organization becomes undercapitalized and can not sufficiently cover cash flow. The demands of the fledging organization go beyond the commitment of the Founder.

Founder or Family Trap: The company growth is stifled by the Founder's strangle hold. Appropriate systems and processes are not adopted and no shift to professional management is made.

Unfulfilled Entrepreneur: Founder pre-maturely steps or is forced aside. Power base shifts back and forth between professional management and Founder. Systems and processes are in place, but not followed.

Premature Aging: The Founder and others leave the organization and it turns over to administrators too early. The organization becomes complacent and ages prematurely.

Stable: The first of the aging stages. The organization is strong, but beginning to loose its flexibility. It is the end of growth and the beginning of decline.

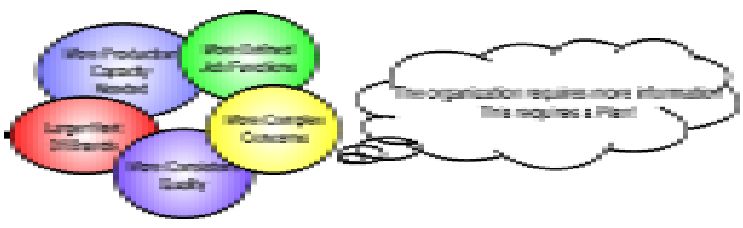
Premise

Many craft or microbrewers view automation of the brewing process as something for the larger corporate brewers and opt for mostly manual breweries. The larger corporate brewers see automation and manufacturing execution systems (MES) of the enterprise as infrastructure critical to their core business success in producing beer. As a smaller brewer expands their production, there comes a point in time where automation provides a solid Return on Investment (ROI) and brings value to the brewer and their beer. This study analyzes the growth cycles of breweries, which are similar to any corporate entity, and defines the point along their growth curve where automating the brewing process provides value. Different trigger points are identified associated with production schedule, labor utilization, and product consistency requirements. Several craft and regional brewers provide input to this study and share their specific experiences and outlook.

Developing an Information Infrastructure

As the organization approaches its Adolescent lifecycle, the challenges of the business are changing.

It is challenging to define a Master Plan for the implementation of automation at the brewery. Coming from a manual process operation and resources



with Brewery Growth

Findings and Conclusions

1. There was a wide variety of adoption of automation within the various organizations. Some of it had to do with the Founder's previous career experience and their comfort level with technology.
2. Adoption of automation is very dependent on the Founder's vision for the brewery from Infancy. Some don't see automation as important, others view it as important because of the following reasons:
   - Uniformity of product, consistency
   - Prevention of incorrect operations or human error
   - Decreased load on the operators so they can perform higher value tasks with a focus on product quality and yield
   - Decreased overall requirements for labor so they don't need to add resources as quickly
   - Better coordination of the process
   - A better understanding of the process through time because of the availability of data

Key Lifecycle stage to establish information infrastructure. Transitioning into this phase often requires a move to a new facility or location as well as new brewing equipment. At this point assets are retained and therefore it makes sense to make the investments in an information infrastructure. There is new, professional management other than the Founder and information is a necessity due to the complexity of the organization

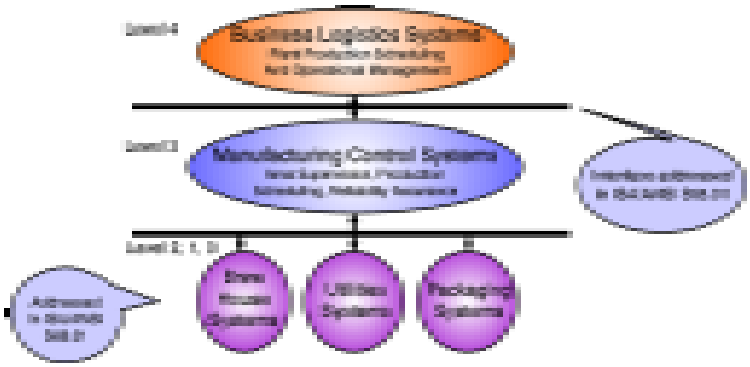
3. Every brewery has some level of automation in instrumentation and controls included as part of packaged equipment.
4. Investments made in a Business System are justifiable earlier in the Corporate Lifecycle as they are portable to a new facility or equipment.
5. The shift to Adolescence represents a divergence of the Founder and the organization. The organization establishes itself as a separate and self-sustaining entity.
6. Brewers in Adolescence are generally brewing and distributing a flagship brand and another supporting brands. Repeatability, consistent quality are more important than in previous lifecycles.

already spread too thin, it is difficult to define what information would be beneficial and what technology is appropriate for a solid return on investment.

The Master Plan

(Plan Globally, Implement Slowly)

Setting up an information infrastructure doesn't mean it needs to be done all at one time. The purpose of a Master Plan is to set a vision so that all of the decisions made are intended to get you step by step closer to the vision of where you want to be. Provision needs to be made for growth in capacity and performance when purchasing decisions are made. There are guiding standards and organizations which define what ideal will be; this just helps to establish the vision and it may never be achieved in its true form, but all the while cost and labor savings are provided each step of the way. This vision should be reviewed on a periodic basis and treated as a living document.



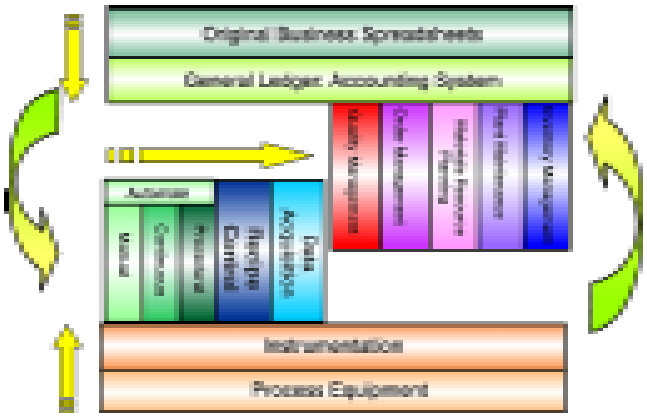
Step 1: Business Objectives. The first step to defining a Master Plan is to define and document the Business Objectives for the information infrastructure. This identifies the playing field to establish the vision. There are layers of functionality and decisions need to be based on the integrated picture, but specific to functionality at each layer.

Step 2: Define User Requirements. Look at each job function within the organization and identify HOW they would use the system, what information they need available to them, and what additional information could help streamline their job functions.

Step 3: Application Landscape. Identify core business processes and supporting systems that exist in the facility today. What will you keep? What should you replace? What systems CAN grow with you into the future? What systems have you outgrown or would inhibit further growth? Are there commonalities of systems? How important is standardization to the organization with respect to maintenance costs, training/knowledge of the systems?

Step 4: Create the Master Plan. Look at the gaps in your Plan and map out a phased, step by step approach to reach your information infrastructure goal. Base your prioritization on the payback you will see from making the various investments. To ensure alignment to your Master Plan:

- Define your requirements clearly when ordering new equipment.
- Define what type of instrumentation you prefer (to minimize spare parts inventory, training costs, and maintenance costs)
- Require open, standards-based systems as opposed to proprietary-based systems so that everything can be easily integrated when you get to that point
- Make sure things are as modular as possible. This will allow the maximize flexibility in your equipment and how it works together over time.



Instrumentation: As the brewery makes investments in incremental brewing, fermentation, or packaging capacity, equipment should be specified with full instrumentation using industrial quality instruments. Flow and temperature measurements may have local readouts and valving may be manual, but make decisions so that instruments can be integrated and controls can be automated in the future. For example, leave room for an actuator on a valve in the piping layout, even though there is not an actuator initially. Consider the use of digital bus technologies and how they can impact operational and maintenance costs, especially if there is a new facility involved. This technology increases the amount of information that is available to the brewery for activities beyond simple automation and reduces wiring costs.

Eliminate Manual Processes and Steps: All efforts should be made to eliminate manual steps in the brewing process like swing panels and manual sampling for quality measurements, where possible, as these may inhibit future automation of the process.

Automate in a Stepwise Fashion

Continuous or Basic Controls: Start by automating the continuous measurements on a platform that can grow over time, but still can handle just a few measurements now. This would include interlocking monitoring, and exception handling as examples. Set up the system infrastructure, get people trained, organize the maintenance processes, but start small with WHAT is controlled.

Procedural Controls: Batch oriented processes can be efficiently controlled following the guidance of the ISA/ANSI S88.01 standard. Many batch control systems on the market follow these guidelines. This standard defines the use of Procedural control layered on top of Basic Controls. Procedural control directs equipment-oriented actions to take place in an ordered sequence in order to carry out a process-oriented task. This approach establishes the business model from the very lowest level of the operation in a manner consistent with how a brewery is operated – per brew/ batch.

Recipe Management: Once you had the ability to control the process automatically, the next phase is the abstraction and management of the recipes. Using the S88 standard facilitates management of the recipes since the recipes themselves are managed separately from the controls that operate the equipment. Recipes can be implemented throughout the process. This helps eliminate scrap and waste and drives down changeover times.

Data Collection

Once fully automated control of the brewing is achieved, the next step should be capturing the brewing and organizational data in a data collection system. This type of system captures data from the brews and retains them in a time series database using special data compression algorithms, with a relational database to provide batch context. The data historian, integrated with batch logging and analysis tools, allows rapid optimization of production flows, process improvements, and in-line quality analysis. For example, this creates the ability to compare one brew to another brew and more detailed process optimization. Brew reports are captured and stored for current and future reference and refinement. This provides a platform for integration with the business system.

— Rajesh Shah

Simulation can Reduce Start-Up Time 75 Percent

Simulation is a tool that can be used in many process automation projects to reduce risk, save money and compress the project cycle. Simulations are created by building a model of the proposed process, usually by using PC-based software packages.

Simulation can provide a proof-of concept in advance of major project expenditures. It can also be used to provide a cost/benefit analysis and a risk assessment for different design approaches.

A case study

A frozen pancake manufacturer wants a conveyor system that would reduce the number of jams that occur when multiple lines of pancakes merged into a stacking area. With the existing conveyor system, pancakes exited the freezer were randomly distributed. Study shows that the pancakes needs to emerge from the freezer in six controlled streams. Next, the system needs to stack the pancakes six high and merge the stacks onto a single-file conveyor.

Product damage directly attributable to the new system should not exceed 0.2 percent, and the system needs to have a runtime efficiency of 96 percent or better.

Minimizing risk

Before embarking on the project, a simulation software is used to create an initial design concept to help calculate product manufacturing variables.

This helps determine project variable specifics and minimize risk. One can know before contract acceptance if it is possible to achieve project goals.

An AutoCAD layout of the project and a schematic with flow rates, frequencies and product distribution is used to program simulation.

Simulation capabilities allow the manufacturer to see the operation dynamically and increase customer confidence. It also assures the design solution would work, and it shows what kind of improvements would result in the manufacturing process.

Saving time

Simulation optimizes the process virtually. Because all the process changes and tweaks are done online, the start-up takes only weeks instead of months.

The result is a manufacturing process that decreased pancake product damage within requested parameters. The solution also reduced the number of employees required to monitor pancake production from four people to one.

Developing the simulation takes more time at the beginning of the project, but it saves considerable time during installation, start-up and debugging. Costs for corrections made in the design phase of a project are miniscule when compared to making corrections during start up.

— Mukund

TOP BENEFITS OF SIMULATION

- Provides a proof-of-concept before major project expenditures.
- Provides a cost/benefit analysis and a risk assessment for different design approaches.
- Reveals design flaws early, when costs for correction are low.
- Reduces installation and start-up time.
- Shows how a retrofit will work within an existing process.

A simulation of proposed frozen-pancake conveyor system allowed corrections in the design phase of the project, where they are significantly cheaper to implement.

Online Viscosity Measurement in the Food Stuffs Industry

Why measure viscosity?

Quality is of paramount importance in the making of creme cheese or syrup as poor quality would cause extensive downtimes in the production process. Downtimes in the process have to be avoided. In the dairy industry, products such as creme or fermented milk products, pudding and dessert are wares whose individual characteristics can be destroyed in part or entirely if the flow characteristics of the goods are not known or are interpreted incorrectly. From the viscosity, the producer recognises the products behaviour which is important for process control and decisive for the quality of the product. Viscosity is a measured value which in earlier times was determined offline and only with great effort. These offline measuring instruments determined only the viscosity itself. Today, one is able to measure mass and volume as well as the density, together with the viscosity of a material.

What is viscosity?

The viscosity of a material is based on the changing behaviour between the molecules in a liquid. These molecules are connected with one another in a certain way. As the mobility of the molecules depends on the temperature, the viscosity of the material can decrease substantially with increasing temperatures. This means that a (flowing) movement leads to internal forces i.e. internal friction. Expressed in another way, viscosity is an indication as to how “easily” a material flows.

It is not unproblematic to measure viscosity.

Physical data such as temperature, pressure and density will influence the measurement of viscosity. The fact that some materials develop differing viscosities in varying process conditions makes it even more complicated. As opposed to solid matter, a liquid is pliable when subjected to force. When encountering a shearing force, the solid material, due to the consistency of the material, is able to deform only in a limited way to be subsequently torn apart and destroyed. A liquid can deform infinitely under the influence of shear forces. This demonstrates that the product quality of a liquid material depends to a large degree on the precise measurement of viscosity in the process. If the viscosity tolerances are under or overstepped, an entire charge can be ruined.

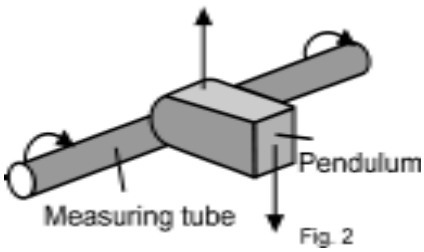


Fig. 2

How is viscosity measured?

With the torsional movement, shear forces are built up between pipe wall and the material inside of the pipes (fig. 1). These shear forces are proportional to the energy required for the generation of the measuring signal.

In this process, the energy which brings the measuring pipe into the measuring frequency is measured. As the instruments are calibrated with several materials of diverse density and viscosity, the exciter as well as the measuring frequencies of the calibration materials are known. This data is stored in the electronics to be used as reference.

Example: If the energy for the exciter frequency has to be increased, it means that the material has a higher viscosity. If however, less energy is required in order to build up the measured frequency, the material has a reduced viscosity. This means an increased or decreased energy expenditure is an indication of the process viscosity.

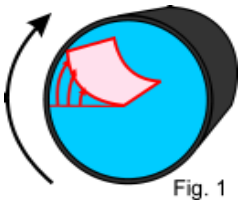


Fig. 1

A patented TMB process (Torsion Mode Balance System) compensates the forces within the measuring instrument caused by the exciter frequency with the pendulum (fig. 2). Due to high exciter frequencies (up to 800Hz) it is ensured that there are no oscillation overlaps between measuring instrument and environment (caused by pumps or motors). As a footnote it must be noted that certain unique instruments do not require intake and discharge sections.

All measured results such as temperature, density, mass and viscosity are shown online in qualitative as well in finite values, depending on the material, to be communicated to the outputs.

The above process used in the generation of measuring signals ensures that the customer receives an intelligent and cost effective solution without increased costs. Today, the importance of viscosity measurement is still often underestimated. If used at all, it is carried out using extensive and time consuming measuring cycles. This task can be carried out in the same measuring cycle along with the measurement of temperature, density and mass flow.

— Michael Mies

Sensors Promise Safety, Better Quality for Food Processors . . . and Consumers

Sensor technology is one of the technologies that will play a major role in the future. It can be used in all sectors of industry to give products added value that make them more competitive. Sensor technology is a rapidly growing area of research. Many products incorporating sensor technology are already on the market and it promises to continue to play a critical role in technologies of the future.

Sensors and sensor systems perform a wide range of sensing functions. They enable products and systems to capture process and communicate information about the status of the system in which it is placed. Sensors are able to capturing information on the chemical composition, texture and morphology, large-scale structure, position and motion of systems in which they are applied. It is a characteristic feature of a sensor that the device is tailored to the environment in which it is to operate.

Technical change-agents affecting sensor markets today include developments in smart sensors, sensor buses for distributed networks, semiconductor technology, and sensor miniaturization, in general.

Because industrial sectors are constantly looking for cutting-edge high performance at a lower cost, smart sensors using microcontrollers are adding intelligence and functionality to various sensor technologies and providing simpler, more intuitive set-up. Innovation will move industrial sensor markets into adopting new technologies including smart sensor capabilities, wireless communications, microelectromechanical systems (MEMS)-based components, plug-and-play sensors, and increased precision. Many of these advanced technologies are available now.

All over the world, food processors are always searching for ways to meet changing consumer demands while delivering products that meet expanding markets for healthy, convenient foods. The food industry thrives on process techniques that take environmental constraints into account, meet food safety requirements and produce high quality products for consumers.

Process efficiency in the food industry can be achieved by incorporating advanced technologies that lower unit costs and improve overall product quality, contributing to higher profits. Finding ways to reduce the number of unskilled human links in automatic material handling systems could be an important breakthrough in reducing workplace injuries resulting from highly repetitive activities. Developing better methods of producing food and enhancing the nutritional value of foods are important, as well.

The sensors are designed to ensure hygienic operation, as well as to withstand the effects of the aggressive cleaning solutions and rapid temperature changes. With inductive and capacitive proximity sensors; flow, temperature and pressure monitors; and photosensors, this product range serves virtually every sensing requirement of food industry. A wide range of accessories, including time- and cost-saving adjustable mounting systems, complements the sensors. manufactured from stainless-steel.

Sensors flush for food!

Flush-mountable inductive proximity sensors which are specifically designed to withstand the rigours of food-industry applications, are available in the market. Some models which are available in both flush-mounting and non-flush-mounting versions.

All of the new sensors have corrosion-resistant stainless-steel bodies, with food-friendly PEEK sensing faces. They offer an IP69K protection rating, and they can operate continuously in ambient temperatures of up to 100ºC without compromising performance or reliability. Full compatibility with CIP operations is assured. The new sensors offer the full benefits like ultra-stable operation, exceptional reliability and extended sensing ranges. New range of flush mounting pressure sensors offer a very attractive choice for applications in the food, beverage and pharmaceutical industries. All sensors in the new range use innovative ceramic cell pressure sensing technology which provides stable, accurate operation with freedom from ageing effects, and which ensures outstanding resistance to over-pressure damage.

Photosensors enjoy a good wash!

Photosensors with their IP68 protection ratings and stainless-steel bodies are an ideal choice for food-industry and other demanding applications where they may be subject to pressure washing or exposure to aggressive cleaning chemicals.

It offers extended sensing ranges, combined with total operating ability over a temperature range of –20ºC to +80ºC. The sensors are manufactured from food-grade materials, and feature smooth, shatterproof lens covers, which resist the build-up of contaminants. For ease of adjustment, OG Wet-Line sensors incorporate Touch-to-Teach setting technology. Users simply press a button once with the target in place, then again with no target, and the sensor automatically adjusts itself for optimum performance.

— Bipin B. Jirge

INTEGRATING MULTI-VENDOR SYSTEMS USING THE RTPM PLATFORM

The RTPM platform is meant to capture real time plant information and providing the means of determining the true source of the problem. It is an events-driven platform that delivers unified, role based portal views of information across the enterprise for executives, management, engineering, operations and business administration. By tying together manufacturing and corporate systems, RTPM empowers everyone in the organization with unparalleled real-time intelligence, enabling them to continuously improve performance. When individuals are empowered to make the right decisions in the right time, enterprise transparency and agility increase, putting the organization on the path toward Operational Excellence.

RTPM unlocks the hidden value in their enterprise, people and systems, its technology for today and the future, It transforms data into understanding so business units, customers and suppliers across the globe can take more informed and immediate actions.

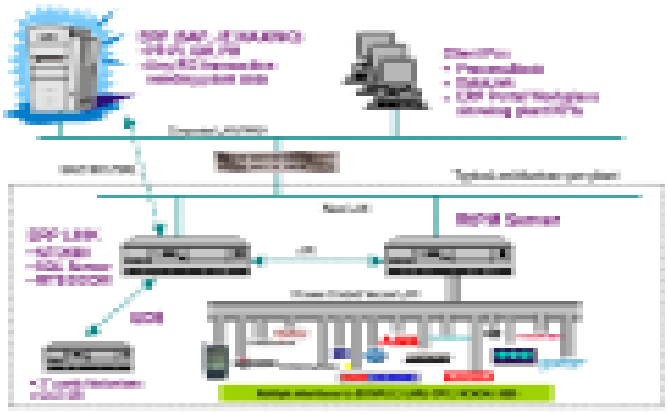
RTPM improves batch quality and plant safety. Reduce your production interruptions so plant quality standards are exceeded and safety is improved.

RTPM maintains critical process parameter targets. Combine real-time batch and statistical quality information with historical data and optimize your plant's capacity. Provide powerful decision making tools so staff are able to view, analyze and report on plant operations and manufactured products.

RTPM increases response and communication. Let users immediately identify and respond to potential process or equipment exceptions, as well as evaluate the potential impact of various scenarios on quality, safety and the environment.

RTPM extends information accessibility. Interface to various databases, lab, environmental and control systems to permit simultaneous data access for immediate graphical display, reporting and decision making.

RTPM reduces unscheduled downtime. Combine real-time process information with predictive maintenance information to reduce unscheduled downtime.



The value delivered from the RTPM System can positively impact

- Inventory management
- Productivity and cost reduction
- Regulatory Compliance
- Asset Optimization and Overall Equipment Effectiveness

— Abraham Samson

REMOTE DCS FOR FISH PROCESSING PLANT

The Maritex facility in Sortland, Norway, sits above the Arctic Circle, where supplies of the raw material, fresh fish, are plentiful. At the factory, internal fish organs are processed into margarine oils, for use as ingredients in traditional health food, such as Omega-3 margarine. The factory also extracts advanced products. These include DNA salts from cod milt, enzymes from cod stomach and peptone, a protein building block. Research into new products continues:

A new process, which includes an evaporator, was implemented using Digital Plant architecture and FOUNDATION fieldbus networked devices, which include Coriolis mass flow meters, pressure and temperature transmitters, and pH transmitters.

Existing 4-20mA field equipment is also interfaced into the DCS. Together with the parent company of Maritex, DCS engineers in Denmark configured the first evaporator over a satellite link. Such a capability is important when working on a facility in a remote location, with no permanent instrument engineers on site. One of the tools in configuration is Asset Management that uses information from field devices to manage plant assets. In the future this can be used to troubleshoot and diagnose plant operational problems and maintenance requirements, also remotely. Digital Plant Architecture is capable of handling everything from monitoring of the tank farm to advanced process control. These advantages continue to be important to us. At the time of the installation, Maritex did not have a process automation department. Since then, they have configured a second evaporator on our own! Continuous changes are taking place all the time in their process equipment and production has become smoother.

The AIA Newsletter is published by the Automation Industry Association. We welcome your feedback and requests for any further information.

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